REMARKS

Claims 1-5 have been rejected under 35 U.S.C. §102(b) as anticipated by Kusase (U.S. Patent No. 5,132,581). In addition, Claims 6 and 9-12 have been rejected under 35 U.S.C. §103(a) as unpatentable over Kusase '581 in view of Kusase et al (U.S. Patent No. 5,483,116). However, for the reasons set forth hereinafter, Applicants respectfully submit that all claims which remain of record in this application distinguish over the cited references, whether considered separately or in combination.

The present invention is directed to a vehicular alternator of the type which has a rotor that is formed by a pair of opposing "claw-type" magnetic poles that are nested together in a manner such that the respective claws of the two poles are interdigitated, and separated by gaps, as best shown in Figure 7 of the application. Permanent magnets are inserted in the gaps between the opposing surfaces of the respective interdigitated claws, to provide auxiliary excitation.

In conventional vehicular alternators of this type, including, for example, that disclosed in Kusase et al '144, the claws of the respective magnetic poles are tapered along their axial extent, so that each claw is thinner (in the radial direction) at its tip and its base. Thus, the claws have a substantially triangular shape in a longitudinally and radially extending section plane, as seen, for example, in Figures 1 and 6 of Kusase et al or in elements 15 and 16. The

purpose of this design of the claws is to minimize the effect of centrifugal forces which causes the claws to flare outwardly at their unsupported ends. Since the mass of the claws is concentrated at the supported ends, such outward flexing of the claws is minimized.

Such a design of the claws, however, also creates a different problem, which has been heretofore unresolved, in that, due to complete lack of contact between the claws, on the one hand (which have approximately rectangular or trapezoidal lateral surfaces, and the entirety of the opposing magnetic pole surfaces of the magnets (which have rectangular shape) on the other hand, resistance to a flow of magnetic flux in the magnetic circuit formed by the permanent magnet is increased (and the magnetic losses as well).

The present invention resolves this further problem by providing a design for the claws which achieves the advantages of a tampered cross-section, referred to previously, and also at the same time provides complete contact between lateral surfaces of the claws and those of the permanent magnets, so that its resistance of the magnetic circuit is minimized. It does so by providing each of the claw-type magnetic poles with a shape such that its surface which faces and abuts the magnetic pole surface of the adjacent permanent magnet makes contact with the entirety of the pole surface. Various embodiments accomplish this structure in differing ways. For example, in the embodiment illustrated in Figures 2 and 3, auxiliary magnetic pole portions 21 are arranged at the lateral

edges of each of the claws 5Aa and 5Ba. The latter extend downwardly and, despite the tapering of the circumferentially central portion of the claws, form a base that corresponds to the shape of the magnetic pole surfaces of the permanent magnets, so that the claw itself makes contact with the entirety of the magnetic pole surface of the permanent magnet.

The latter features of the invention, which achieve the advantages set forth above, are incorporated into each of the independent claims of the present application. Claim 1, for example, recites that each of the claws is cantilevered at a proximal end thereof, and extends axially to a distal end, opposite the proximal end, and furthermore that "each of said claws has, in a circumferentially central portion thereof, a radially thickness that is tapered along an axial direction, being thicker at said proximal end than at said distal end thereof". Finally, Claim 1 further recites that through the opposing lateral surfaces of the claws adjacent the permanent magnets are formed into substantially the same rectangular shape as that of the magnetic pole surfaces of the permanent magnet with which they are in contact, such that the lateral surfaces of the claws contact the whole of the rectangular lateral magnetic pole surfaces of the permanent magnets. Claim 10 is similarly limited, reciting that a circumferentially central portion of each of the claws is tapered toward a tip of the claw, such that the circumferentially central portion has a substantially triangular or trapezoidal shape in a radial section plane along an axial direction

of the rotor, and furthermore that each of the claws has an auxiliary magnetic pole portions formed at circumferentially lateral ends thereof which project radially inwardly from the circumferentially central portion of the claws and have substantially the same rectangular shape as the magnetic pole surfaces with which they are in contact. Finally, Claim 11 recites that each of the claws has a proximal end portion at which it is cantilevered, and a distal end portion having a radial thickness that is thinner than the proximal end portion. In addition, Claim 11 recites that each of the permanent magnets has a radial thickness that is greater than the radial thickness of the distal end portion of the claws. In addition, Claim 11 also recites that the magnetic pole surfaces of the permanent magnets that are interposed between adjacent claws have a first portion which faces a corresponding one of the lateral portions of the claws in a remaining portion which does not face the corresponding lateral portions of the claws. Finally, Claim 11 also recites that the claws according to the invention include auxiliary magnetic pole portions which are in contact with substantially the whole area of the magnetic pole surfaces of circumferentially adjacent permanent magnets, including the remaining portion, for enabling magnetic flux outgoing from the remaining portion to flow into the claws.

The latter features of the invention are neither taught nor suggested by the Kusase '581 reference. In particular, as can be seen from Figures 1 and 3, each of the claws, 223 has a cross-section in the axially direction which has a

uniform radial dimension, and which is constant in a circumferential direction. (That is, the radial cross-section pole does not vary as the radial section plane as rotated about the axis of rotation.) Thus, while the lateral surfaces of the claws 223, 213 in Kusase '581 have the same rectangular shape as the lateral surfaces of the permanent magnets, and therefore make contact with the entire surface of the permanent magnets, they do so at the expense of maintaining a uniform radial thickness, such that a large amount of mass is distributed toward the unsupported end of each claw, thereby aggravating the problem created by centrifugal forces, as discussed previously.

More particularly, Kusase et al does not disclose a configuration in which each of the claws has, in a circumferentially central portion thereof, a radial thickness that is tapered along an axial direction, being thicker at said proximal end than at said distal end thereof as recited in Claim 1. Similarly, it also does not teach or suggest a configuration in which a circumferentially central portion of each claw is tapered toward a tip thereof, such that the circumferentially central portion has a substantially triangular or trapezoidal shape in a radial section plane along an axial direction of the rotor as recited in Claim 10. It also does not provide auxiliary magnetic pole portions formed at circumferentially lateral ends of the claws, which project radially inwardly from the circumferentially central portion of the claws that is tapered as recited. Finally, Kusase '581 also neither teaches nor suggest that each claw has a promixal end

portion at which the claws is cantilevered, and a distal portion having a radial thickness that is thinner than the proximal end portion. Moreover, it also does not disclose that each of the permanent magnets has a radial thickness that is greater than the radial thickness of the distal end portion of the claws.

On the other hand, the Kusase et al '144 reference, as noted previously provides the claws with a tapered cross-section, but lacks the auxiliary magnet pole portions which project inwardly, as recited in the claims of the present application, so that, although the radial cross-section of a circumferentially central portion of the claw is substantially triangular (achieving the advantages referred to previously regarding centrifugal force), the radial cross-section of the auxiliary magnetic pole portion differs from that of the circumferentially central portions, and has a shape which corresponds to that of the permanent magnets, making complete contact with the service of the permanent magnets.

Neither of the Kusase '518 or Kusase et al '144 references suggests such a novel configuration for the claws, which achieves both of the advantages (regarding centrifugal force and magnetic resistance) recited above.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general,

a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #381KA/50358).

Respectfully submitted,

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